BC Lake Stewardship and Monitoring Program

Shawnigan Lake 2012-14

A partnership between the BC Lake Stewardship Society and the BC Ministry of Environment and Climate Change Strategy

BCLSS

BRITISH COLUMBIA
Ministry of Environment and Climate Change Strategy

The Importance of Shawnigan Lake & its Watershed

British Columbians want lakes to provide good water quality, aesthetics, and recreational opportunities. When these features are not apparent in our local lakes, people begin to wonder why. Concerns often include whether the water quality is getting worse, if the lake has been impacted by land development or other human activities, and what conditions will result from more development within the watershed.

The BC Lake Stewardship Society (BCLSS), in collaboration with the Ministry of Environment and Climate Change Strategy (ENV), has designed a program, entitled *The BC Lake Stewardship and Monitoring Program*, to address these concerns. Through regular water sample collections, we can come to understand a lake's current water quality, identify the preferred uses for a given lake, and monitor water quality changes resulting from land development within the lake's watershed. There are different levels of lake monitoring and assessment. The level appropriate for a particular lake depends on the funding and human resources available. In some cases, data collected as part of a Level I or II program can point to the need for a more in-depth Level III program. This report gives the 2012-14 results of a Level I program for Shawnigan Lake.

The BCLSS can provide communities with both lake-specific monitoring results and educational materials on general lake protection issues. This useful information can help communities play a more active role in the protection of the lake resource. Finally, this program allows government to use its limited resources efficiently with the help of local volunteers and the BCLSS.

A **watershed** is defined as the entire area of land that moves the water it receives into a common waterbody. The term watershed is misused when describing only the land immediately around a waterbody or the waterbody itself. The true definition represents a much larger area than most people normally consider. The watershed area of Shawnigan Lake is 69 km^2.

Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no "new" water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution.

Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately surrounding a waterbody. Poor land use practices in a watershed can eventually impact the water quality of the downstream environment.

Shawnigan Lake is the second largest lake on Southern Vancouver Island. It is located approximately 48 km north of Victoria and borders the communities of Cobble Hill and Mill Bay.

Shawnigan Lake is a drinking water source and has significant fisheries and recreation values. The lake has two day-use provincial parks, West Shawnigan Lake and Memory Island, which are cooperatively managed with the Cowichan Valley Regional District (CVRD). The lake has several beaches and provides recreational uses such as canoeing, fishing, swimming, hiking, waterskiing, paddle boarding and windsurfing.

Shawnigan Lake has a surface area of 5.37 km^2 (537 ha), a volume of over 64 Mm^3, a mean depth of 12 m, and a maximum depth of 52 m. It is approximately 7.2 km long and 1.4 km across at its widest point. The narrowest point is approximately 150 m wide in the West Arm; this part of the lake is quite distinct in that it is a long, narrow, shallow arm isolated from the main body of the lake. The lake has one main deep basin in the northern half of the lake and several smaller basins to 28 m in the southern half (Rieberger, Epps, & Wilson, 2004).

Shawnigan Lake has three main inflows: Shawnigan Creek at the south end of the lake, McGee Creek on the west shore, and the West Arm inflow in the northwest corner of the lake. The lake flows out at the northern end into Lower Shawnigan Creek and drains into Saanich Inlet. The water level of the lake is controlled by a weir on Shawnigan Creek located 450 m downstream from the lake outlet (Rieberger et al., 2004).

The lake contains rainbow trout, sculpin (general), coho salmon, cutthroat trout, kokanee, yellow perch, brown catfish, pumpkinseed, smallmouth bass, black catfish, and threespine stickleback (FIDQ, 2018). Shawnigan Lake School has contributed to these fish observations since 1997 (Noble, 2019). The lake has been stocked with rainbow trout yearly since 1980 and less frequently prior to then (FIDQ, 2018).

What's Going on Inside Shawnigan Lake?

Temperature

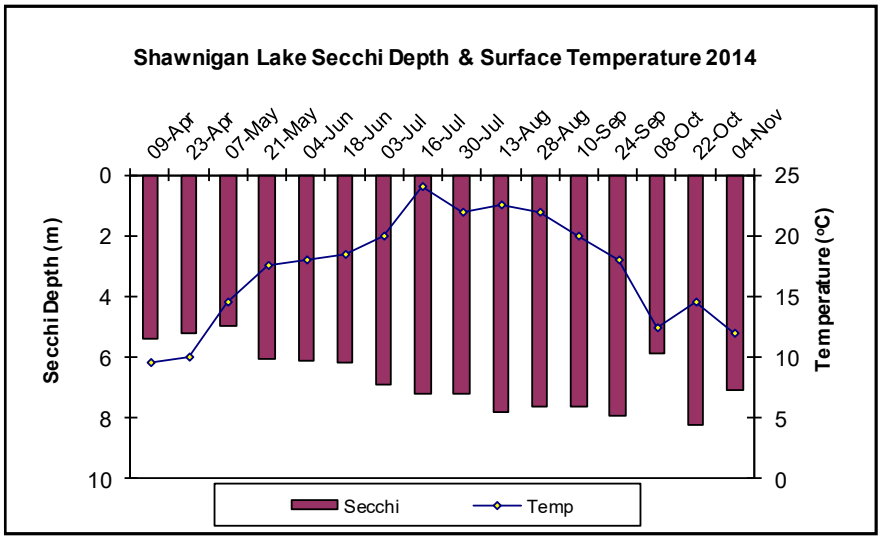
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is denser, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these lakes usually mix from top to bottom (overturn) as wind energy overcomes the reduced temperature and density differences between surface and bottom waters. In the winter, lakes re-stratify under ice with the densest water (4 °C) near the bottom. These lakes are called dimictic lakes because they turn over twice per year. They are the most common type of lake in British Columbia.

Coastal lakes in BC are more often termed warm monomictic lakes because they turn over once per year. These lakes have temperatures that do not fall below 4°C. Warm monomictic lakes generally do not freeze and circulate freely in the winter at or above 4°C, and stratify only in the summer. Shawnigan Lake is classified as a monomictic lake.

Ice-on and ice-off dates for BC lakes are important data for climate change research. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Shawnigan Lake does not freeze over. In extreme cold weather events when the air temperature is below zero, the surface waters have occasionally been measured at 0-1°C. The lake can occasionally have temporary light ice cover in protected shallow bays in extremely cold conditions.

Surface temperature readings serve as an important ecological indicator. By measuring surface temperature, we can record and compare readings from season to season and year to year. Surface temperature helps to determine much of the seasonal oxygen, phosphorus, and algal conditions.

Surface temperature (T) and Secchi depth (water clarity) were measured at the deepest basin from 2012-14 (site marked on map on p. 3). Minimum data requirements were met for all years. The adjacent graph illustrates the 2014 Secchi and surface temperature data from the deep station. In 2014, the maximum temperature measured was 24°C (Jul 16) and the minimum was 9.5°C (Apr 09).

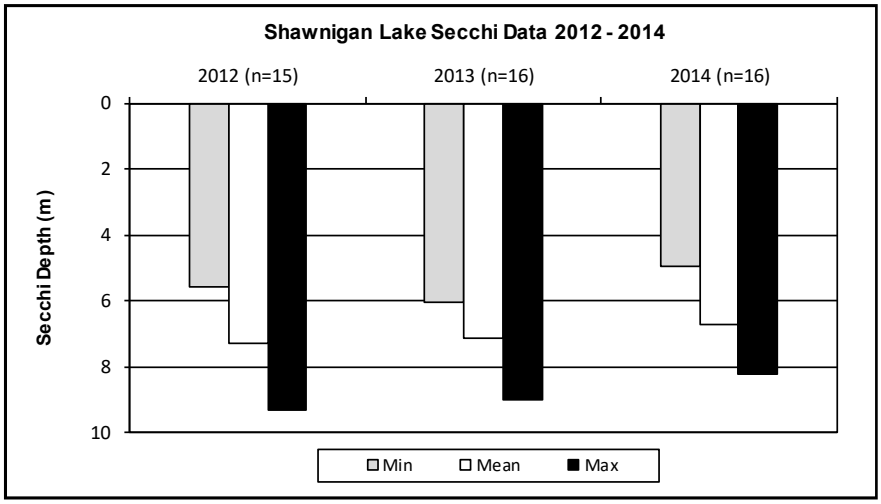


Trophic Status and Water Clarity

The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including tiny floating algae called phytoplankton. Algae are important to the overall ecology of the lake because they are food for zooplankton, which in turn are food for other organisms, including fish. In most lakes, phosphorus is the nutrient in shortest supply and thus acts to limit the production of aquatic life. When in excess, phosphorus accelerates growth and may artificially age a lake. Total phosphorus (TP) in a lake can be greatly influenced by human activities.

One measure of productivity is water clarity. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water can be evaluated by using a Secchi disc, a 20 cm diameter black and white disc that measures the depth of light penetration.

Natural variation and trends in Secchi depth and temperature not only occur between years, but also throughout one season. In general, as temperatures increase during the summer months, Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity can decrease. This general trend is not apparent in the 2014 data for Shawnigan Lake.



The adjacent graph shows the minimum, average and maximum Secchi readings at the deepest basin from 2012 -14 and the number of readings for each year (n). The maximum reading during these years was 9.30 m (2012) and the minimum was 4.95 m (2014). The average Secchi readings were 7.27 m, 7.13 m, and 6.71 m for 2012-14 respectively. The overall water clarity has remained fairly consistent since 1976.

Based on these summer average Secchi values, Shawnigan Lake was exhibiting oligotrophic (>6 m Secchi depth) conditions (Nordin, 1985). This is consistent with the previous findings of Nordin and McKean (1984) and the Ministry of Environment. Data show that Shawnigan Lake has remained stable throughout the sampling period.

The flushing rate, another factor that affects water quality, is the rate of water replacement in a lake and depends on the amount of inflow and outflow. The higher the flushing rate, the more quickly excess nutrients can be removed from the system. The flushing rate for Shawnigan Lake is one year (Nordin and McKean, 1984).

Land Use and Pollution Sources

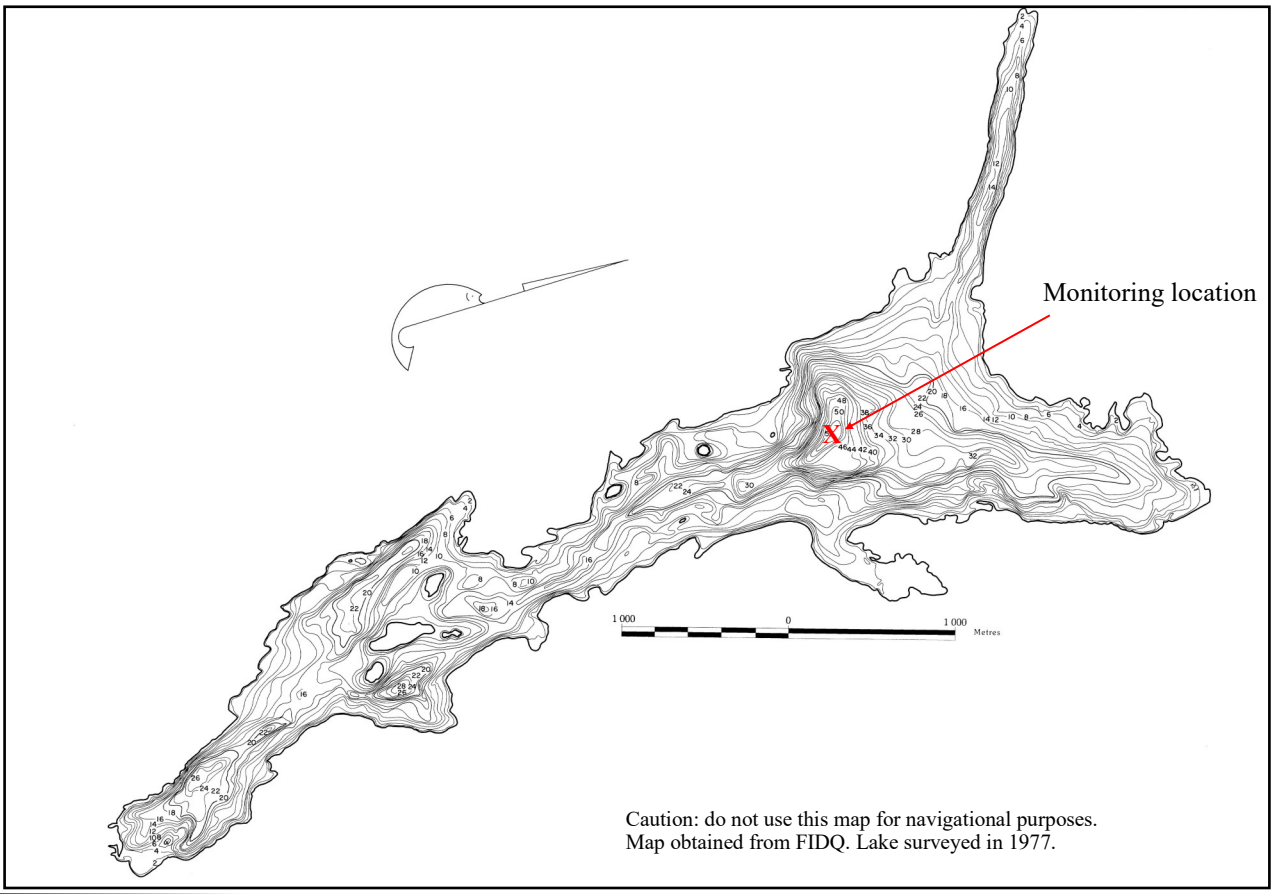
Human activities that impact water bodies range from small, widespread and numerous *non-point* sources throughout the watershed to large *point* sources of concentrated pollution (e.g. outfalls, spills, etc.). Undisturbed watersheds have the ability to purify water and repair small amounts of damage from pollution and alteration. However, modifications to the landscape and increased levels of pollution impair this ability.

Forestry is the dominant land use in the higher elevation portions of Shawnigan Lake watershed with urban development and agriculture using the majority of the remaining land base. Approximately 9.5% of the land base is under the Agricultural Land Reserve (ALR) (Rieberger et al., 2004).

The majority of the lake residences are now occupied year-round and there are a number of recreational areas and resorts that receive the heaviest use in the summer months (Rieberger et al., 2004). Continued growth and development within the watershed, in addition to a high level of recreational use, will present challenges to maintaining water quality. Information on keeping Shawnigan Lake healthy can be found on the following page.

A major public concern over the past few years was the decision in 2013 to allow a contaminated soil landfill and treatment operation in the upper Shawnigan Creek watershed. A community campaign was launched over the potential concerns for contamination of Shawnigan Lake. The permit was cancelled in 2017, however a large volume of soil was deposited at the private company's landfill site and continues to be a concern for local residents.

Shawnigan Lake Bathymetric Map



Should Further Monitoring be Done on Shawnigan Lake?

Generally, trophic status is based on a combination of parameters such as Secchi, nutrients, and chlorophyll *a*. The data collected by volunteers on Shawnigan Lake from 2012-14 indicate that the water quality has remained stable throughout the sampling years. Average annual Secchi readings place the lake in the oligotrophic classification. This is consistent with historical data dating back to 1970. This classification is desirable from a recreational and drinking water supply water quality perspective (Rieberger et al., 2004).

Comprehensive monitoring took place by ENV and CVRD in 2013 and again in 2018 on Shawnigan Lake in response to concerns over possible deterioration of water quality. The draft 2013 report concluded that the lake remains oligotrophic and there is no indication of overall lake deterioration. A recommendation made in the Ministry's Shawnigan Lake Water Quality Assessment (1976-2004) suggested that support be provided to organized lake stewards to continue with basic water quality sampling through the BC Lake Stewardship Society. Other activities for lake stewards could include monitoring of aquatic macrophyte growth and distribution, and tracking sportfishing catches to monitor fish populations (Rieberger et al., 2004). All residents and land developers within the watershed are advised to practice good land management so that nutrient migration to the lake and its tributaries are minimized.

Tips to Keep Shawnigan Lake Healthy

Onsite Sewage Systems

- Inspect your system yearly, and have the septic tank pumped every 2 to 5 years by a septic service company. Regular pumping is cheaper than having to rebuild a drain-field.
- Use phosphate-free soaps and detergents.
- Do not put toxic chemicals (paints, varnishes, thinners, waste oils, or pesticides) down the drain because they can kill the bacteria at work in your onsite sewage system and can contaminate waterbodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow showerheads and toilets.

Yard Maintenance, Landscaping and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Replant lakeside grassed areas with native vegetation. Do not import fine fill.
- Use paving stones instead of pavement.
- Stop or limit the use of fertilizers and pesticides.
- Do not use fertilizers in areas where the potential for water contamination is high, such as sandy soils, steep slopes, or compacted soils.
- Do not apply fertilizers or pesticides before or during rain due to the likelihood of runoff.
- Hand pull weeds rather than using herbicides.
- Use natural insecticides such as diatomaceous earth.
- Prune infested vegetation and use natural predators to keep pests in check. Pesticides can kill beneficial and desirable insects, such as ladybugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.
- Pick up after your pets as their waste can lead to bacterial contamination of lake water.

Boating

- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals.
- Conduct major maintenance chores on land.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Use absorbent bilge pads for minor leaks or spills.
- Recycle used lubricating oil and left over paints.
- Clean off all aquatic plants, animals, and mud from boats and equipment before entering or leaving a lake.
- Do not use metal drums in dock construction. They rust, sink and become unwanted debris. Do not use non-encapsulated Styrofoam as this material often breaks up, litters beaches, and may be consumed by fish and other wildlife. All floats should be labelled with the owner's name, phone number, and confirmation that barrels have been properly maintained.
- Leading by example is often the best method of improving practices - help educate fellow boaters.

Who to Contact for More Information

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Bathymetric Map: FIDQ (Fisheries Inventory Data Query)

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